The Newsletter of NOAA's National Weather Service in Green Bay, Wisconsin

www.weather.gov/grb

Packerland Weather News

Volume 10, Issue 1 Spring/Summer 2012

Inside this issue:

March 2012: Unprecedented Record Warmth

By Roy Eckberg, Forecaster

The first signs of spring occurred on March 6th with highs in the 50s and lower 60s, but the unprecedented warmth across north-central and northeast Wisconsin occurred from March 10th through March 24th. In the Green Bay forecast area, which covers 22 counties across north-central and northeast Wisconsin, at least one location reported a record high temperature or record high minimum temperature on every day between the 10th and 24th except for the 13th. On the 13th, a cold front that moved across the area the night before brought temperatures closer to normal. The peak of the heat wave occurred from the 14th to the 24th when daily departures ranged from 25 to 40 degrees above normal. On the 20th, Green Bay averaged 37 degrees above normal for the date. This established a new record for the greatest daily above normal temperature departure for any single date since records began in 1886. The old record of 34 degrees above normal occurred on March 8, 2000. More record highs were reported on the 27th at Marshfield.

Many daily record high temperatures and record high minimum temperatures were broken by 10 to 20 degrees between the 14th and 24th. Several locations also reported the earliest 80 degree temperature for so early in the year. Many sites also recorded the most number of days above 60, 70 and 80 degrees during the month of March. Usually during the spring, nighttime lows fall back into the 40s due to the cooler ground, longer nights or the cooling effects of the lake breeze off the waters of Green Bay or Lake Michigan. During this warm spell, this was not the case as most sites away from the bay and lake reported lows well into the 50s to around 60. At Wausau, the low temperature of 60 on the 21st was the earliest low temperature of 60 degrees. The previous earliest low temperature of 60 was 62 degrees on April 16, 1921, nearly a month later than the newly established record. It was the same story for Wisconsin Rapids which reported a low of 60 degrees on the 21st. The previous earliest low temperature of 60 degrees was 64 degrees on April 15, 1929. The combination of unseasonably warm days and mild nights allowed for many locations to record a number of cooling

degree days for the month of March. As a matter of fact, some sites reported the first cooling degree ever during the month of March. The above normal temperatures came to an end on the 29th and 30th.

Overall, March 2012 will go down in the record books as the warmest March on record. Temperature departures were 14 to 17 degrees above normal for the month away from the waters of Green Bay and Lake Michigan. Temperatures near the bay and lake averaged 10 to 13 degrees above normal. Most locations broke their previous warmest March on record by an astounding 4 to 6 degrees!

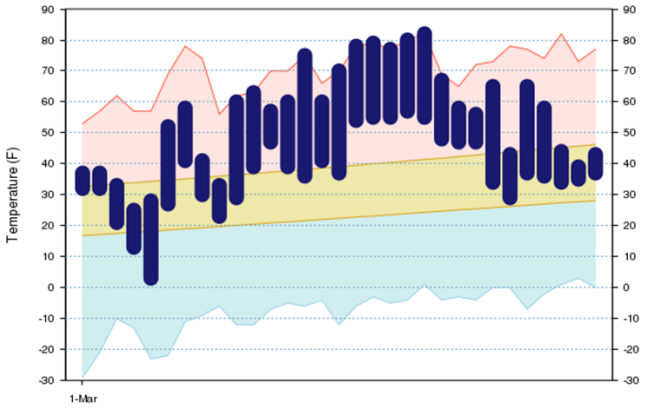
The main impacts of the extremely warm March were to agricultural interests. The green-up and flowering of plants occurred 4 to 6 weeks earlier than normal.

The early warmth concerned area growers due to the potential for a hard freeze later in the spring which would cause significant damage to crops. Also, the National Weather Service in Green Bay began to issue freeze advisories in late March when temperatures were expected to fall to 28 degrees or lower. The freeze headlines normally do not start until late April or early May. During the extremely warm stretch of weather, several grass fires were reported across the area. One of these fires forced Interstate 43 to shut down near Green Bay for a short period of time. One benefit of the unprecedented warm weather was that less fuel was used by home owners to heat homes during the month.

(Please see page 2 for detailed statistics)

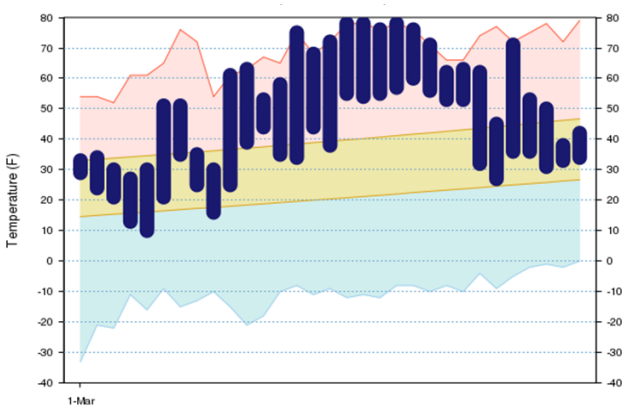
Location	2012 Average March Temperature	Normal	Departure From Normal	March 2012 Ranking	Warmest or Previous Warmest March on Record	Year(s)
Antigo	42.1	26.5	+15.6	Warmest	40.4	1910
Appleton	46.4	31.3	+15.1	Warmest	42.1	1910
Brillion	44.7	31.0	+13.7	Warmest	39.0	2000
Chilton	46.2	31.6	+14.6	Warmest	41.8	1945
Clintonville	45.7	29.9	+15.8	Warmest	40.1	1973
Green Bay	46.3	30.8	+15.5	Warmest	41.4	1910
Hancock	48.0	31.3	+16.7	Warmest	42.5	1910
Kewaunee	42.3	30.6	+11.7	Warmest	40.1	1945
Laona	41.1	26.2	+14.9	Warmest	35.1	1973
Manitowoc	42.6	31.8	+10.8	Warmest	40.9	1945
Marinette	43.4	30.4	+13.0	Warmest	40.5	1946
Marshfield	46.3	30.4	+15.9	Warmest	39.9	1946
Merrill	43.7	28.0	+15.7	Warmest	42.1	1910
New London	46.1	30.5	+15.6	Warmest	42.3	1910,1945
Oconto	44.5	29.9	+14.6	Warmest	40.7	1910
Oshkosh	47.4	32.3	+15.1	Warmest	42.9	1910
Peshtigo	42.6	27.6	+15.0	Warmest	35.5	2010
Rhinelander	42.9	27.1	+15.8	Warmest	38.4	1946
Shawano	44.1	30.0	+14.1	Warmest	40.3	1945
Stevens Point	46.0	30.3	+15.7	Warmest	40.7	1946
Sturgeon Bay	42.3	30.3	+12.0	Warmest	39.7	1946
Two Rivers	41.2	31.0	+10.2	Warmest	38.6	2000
Washington Island	38.9	28.6	+10.3	Warmest	37.7	2000
Waupaca	46.4	31.3	+15.1	Warmest	40.6	1973
Wausau	45.8	30.0	+15.8	Warmest	43.3	1910
Wisconsin Rapids	47.7	31.7	+16.0	Warmest	40.8	1945,2010

Temperature Summary for Green Bay Area
March 1, 2012—March 31, 2012



Observed daily maximum and minimum temperatures are connected by dark blue bars. Area between normal maximum and minimum temperatures has tan shading. Red lines connected record high temperatures. Light blue line connects record low temperatures.

Temperature Summary for Wausau Downtown Airport
March 1, 2012—March 31, 2012



Observed daily maximum and minimum temperatures are connected by dark blue bars. Area between normal maximum and minimum temperatures has tan shading. Red lines connected record high temperatures. Light blue line connects record low temperatures.

Are You Ready for Severe Weather this Season?

Even though spring has been relatively quiet, this is the time of year when the severe weather season starts in earnest. It's never too late to prepare for severe summer storms. Each year across the U.S., many people are killed or seriously injured by tornadoes and severe thunderstorms despite advance warning.

Some do not hear the warning, while others receive the warning but do not believe it will happen to them. Preparing before the storms strike could save your life. Here's what you can do before severe weather hits:

- Develop a plan for you and your family at home, work, school, and outdoors.
- Identify a safe place to take shelter.
- Have frequent drills.
- Know the county name in which you live or visit.
- Keep a highway map nearby to follow storm movement from weather bulletins.
- Have a NOAA Weather Radio with a warning alarm and battery back-up.
- Check the weather forecast before leaving for extended periods outdoors.
- When going outdoors, bring along a portable weather radio. Watch for signs of approaching storms.

When conditions are favorable for severe weather to develop, the National Weather Service issues a severe thunderstorm or tornado **WATCH**. A severe weather watch is usually issued two to six hours before storms develop. When a watch is in effect, keep an eye to the sky and stay tuned to weather radio or local media for weather updates.

When severe weather begins to develop, **WARNINGS** are issued to alert the public and emergency officials. Warnings for severe weather are usually issued 10 to 60 minutes before the storms hit. When a warning is issued for your area, put your emergency weather plan into action.

www.weather.gov/grb/prepare

Weather Service Taking Action to Build a Weather-Ready Nation

By Jeff Last, Warning Coordination Meteorologist

The National Weather Service recently launched a comprehensive initiative to build a "Weather-Ready Nation" to make America safer. The program will enhance services to save more lives and protect livelihoods as communities across the country become increasingly vulnerable to severe weather events, such as tornado outbreaks, intense heat waves, flooding, active hurricane seasons, and solar storms that threaten electrical and communication systems.

More than 1,000 lives were lost in 2011 to extreme weather, including 550 from tornadoes. And the economic losses are equally staggering — at least 14 separate weather disasters, each with $1 billion or more in economic losses. Last year's total losses have amounted to more than $50 billion.

In partnership with other government agencies, researchers, and the private sector, the NWS is charting a path to a weather-ready nation through:

- Improved precision of weather and water forecasts and effective communication of risk to local authorities;
- Improved weather decision support services with new initiatives such as the development of mobile-ready emergency response specialist teams;
- Innovative science and technological solutions such as the nationwide implementation of Dual Pol radar technology, Integrated Water Resources Science and Services, and the Joint Polar Satellite System;
- Strengthening joint partnerships to enhance community preparedness;
- Working with weather enterprise partners and the emergency management community to enhance safety and economic output and effectively manage environmental resources.

The NWS is also planning innovative, community-based test projects across the country, ranging in focus from emergency response to ecological forecasting, to enhance the agency's preparedness efforts to better address the impacts of extreme weather. Test projects will initially be launched at strategic locations in the Gulf Coast, South and mid-Atlantic.

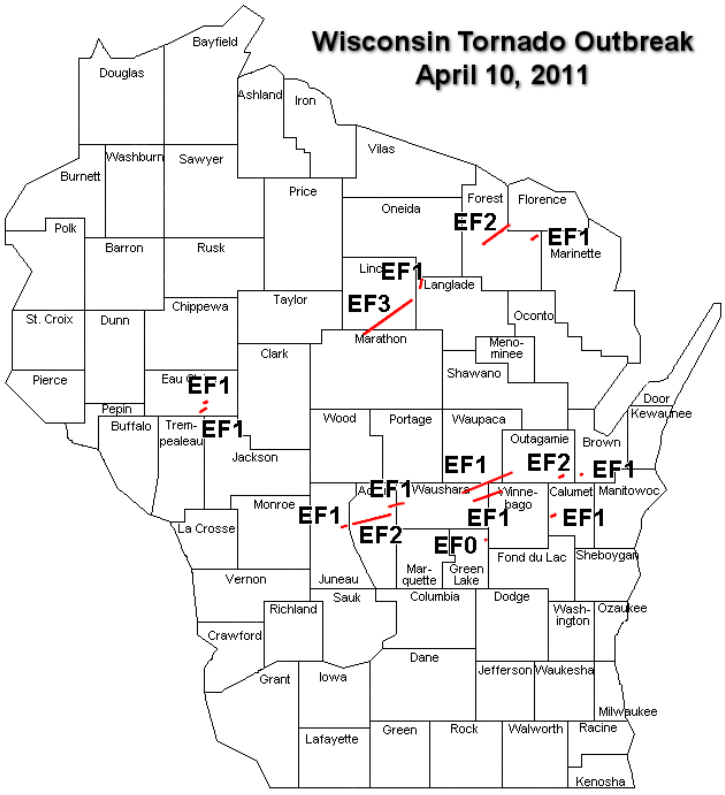
The NWS office in Green Bay developed a "Weather-Ready Wisconsin" safety presentation that will be made available to emergency managers, libraries, and others interested in helping their communities prepare for severe weather.

For more information, check out the Weather-Ready Nation website: **www.weather.gov/com/weatherreadynation**

A Look Back:
Record April Tornado Outbreak in Northeast Wisconsin on April 10, 2011

An outbreak of severe thunderstorms and tornadoes tore across central and northeast Wisconsin during the evening of April 10, 2011. Fifteen tornadoes were confirmed in Wisconsin, most across the central and northeast part of the state.

Ten of the fifteen twisters touched down in the NWS Green Bay service area. The hardest hit areas included Waushara, Winnebago and southeast Outagamie counties in east-central Wisconsin, southern Lincoln County in north-central Wisconsin, and Forest County in the northeast part of the state. The ten tornadoes on April 10 is the largest tornado outbreak ever recorded in the NWS Green Bay service area. For Wisconsin, 15 tornadoes is a record April outbreak. The strongest tornado occurred near Merrill, where a twister over a quarter mile wide caused considerable damage to homes, buildings, and trees on the north side of the city. Ten planes at the Merrill airport were damaged, three destroyed. The tornado was rated EF3 on the Enhanced Fujita (EF) tornado intensity scale. In addition to the tornadoes and large hail, several areas of damaging, straight-line winds were reported. Some of these "downburst" winds exceeded 80 mph, as strong as a tornado!



Tornado tracks on April 10, 2011

Picture of the large tornado in Merrill near the time of peak intensity (courtesy of Julia Berg)

Picture of the tornado moving away from Merrill (courtesy of Samuel L. Hall)

Did You Know?

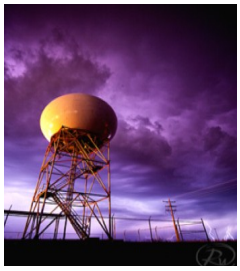
- Tornadoes can occur at any time of the day, any day of the year.
- No geographic location is safe from tornadoes.
- Highway overpasses DO NOT provide safe shelter from tornadoes.
- Tornado circulations can develop from either the ground upward or from the middle and low levels downward.
- Tornadoes are ranked on the Enhanced Fujita Scale (see right).

EF-SCALE	
EF RATING	**3 Second Wind Gust (mph)**
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

NWS Green Bay WSR-88D Receives Dual Polarization Upgrade

By Tasos Kallas, Forecaster

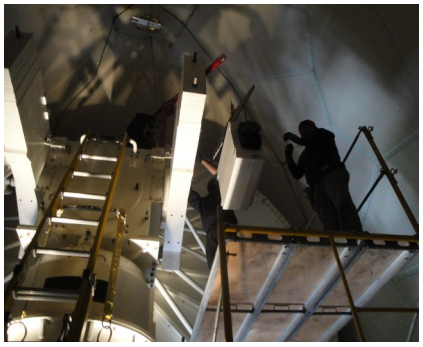
During a one-week period, which began April 20, 2012, the Doppler radar at the National Weather Service Forecast Office in Green Bay underwent an upgrade to incorporate new technology. This much anticipated upgrade is part of the NWS vision to build a Weather-Ready Nation to better protect lives and livelihoods. This exciting upgrade will incorporate a new technology called dual polarization, or dual-pol. This new technology will result in 14 new radar products that will enable us to continue providing our suite of high quality products and services to the public.



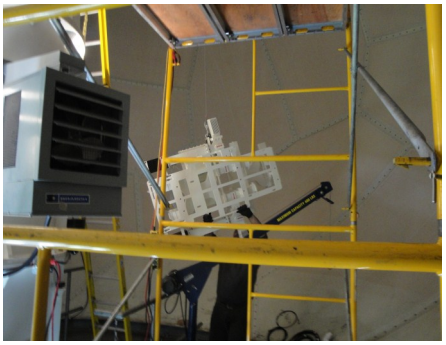
So what are the benefits of the new radar? Since the new radar can now measure both the horizontal and vertical dimensions of meteorological targets (such as rain and hail), we can obtain better estimates of the size, shape, and variety of these targets. This new information will allow meteorologists to have:

- A better estimation of total precipitation amounts;
- A better estimation of the size distribution of hydrometeors (raindrops, snowflakes, hailstones, drizzle);
- A much improved ability to identify areas of extremely heavy rainfall that are closely linked with flash floods;
- Improved detection and mitigation of non-weather related radar echoes (chaff, smoke plumes, ground clutter);
- An easier identification of the melting layer (helpful for identifying snow levels in higher terrain);
- Improved ability to classify precipitation type.

Radar dish pointed vertically



Technicians working to install new parts



Dual-Pol radar part

NWS Expands Into More Social Media

Twitter, the social networking and microblogging service, will soon be another source for weather stories and information from the NWS in Green Bay. Several NWS offices across the country have been experimenting with Twitter to disseminate weather-related content to their "followers". Results from the test offices have been evaluated and the service will soon be available for all NWS offices.

Twitter will join Facebook as yet another way the NWS shares information with the public and its partners.

twitter

facebook

https://www.facebook.com/US.NationalWeatherService.GreenBayWI.gov

Lightning Kills, Play it Safe

Summer is the peak season for one of the nation's deadliest weather phenomena—lightning. If you are outdoors and a storm approaches, move to a sturdy building or metal vehicle immediately. Remember, if you can hear thunder, you are close enough to that storm to be struck by lightning.

Coaches, sports officials, and others responsible for outdoor groups should have a NOAA Weather Radio handy for the latest weather information.

www.lightningsafety.noaa.gov

New Marine Observations Available Soon!

By Teri Egger, Senior Forecaster

The Green Bay National Weather Service is once again working to enhance our marine program by rejuvenating our relationship with our local Coast Guard Stations. We have been selected as a test site for automating the receipt and transmission of weather reports from the Coast Guard.

The United States Coast Guard has a long history of taking weather observations. It started with the light keepers from the old Lighthouse Service to the weather ships they manned during the early years of World War II.

In the early 80s, in conjunction with the USCG's Lighthouse Automation and Modernization Program (LAMP), the National Weather Service's National Data Buoy Center installed its first fixed weather station for the Coastal-Marine Automated Network (C-MAN). These C-MAN stations collected the weather observations that would have been lost when the Coast Guard removed their station keepers from the coastal lighthouses under its modernization program. Our closest C-MAN site is at Sheboygan Light. At the same time, the Coast Guard Stations in Two Rivers and Sturgeon Bay were taking daily observations through a Memorandum of Agreement between the Coast Guard and the National Weather Service to keep the valuable weather information along our coastlines flowing. Through the years though, many of the observations were not received in a timely manner by the marine forecasters. A lack of feedback and use of the observations also led to a loss of observations, with some Coast Guard Stations discontinuing observations.

This past year, Pat Hein, Observing Program Team Leader (OPL) at NWS Green Bay, and NWS Central Region support staff worked with the Coast Guard to regenerate the coast guard observation program around the Great Lakes with NWS Green Bay as the test site. Working with Two Rivers and Sturgeon Bay, Hein is evaluating whether WXCODER III, a climate program, can be used as a means to transmit the observations in real time to our office. So far, the test is a success. It is such a success that you can look for these same observations to be made available via NOAA Weather Radio in the near future.

Sturgeon Bay Coast Guard Station

Two Rivers Coast Guard Station

Fischer-Porter Rain Gauge Receives Major Upgrade

By Scott Cultice, Hydrometeorological Technician

There are over 2200 Fischer-Porter Recording Precipitation Gauges in the United States, with 14 of them located within the NWS Green Bay area of responsibility. So far this year, our OPL Pat Hein, and Hydrometeorological Technicians, Dan Clark and Scott Cultice, have installed all of the 14 new digital, computerized mechanisms in our area. Prior to the upgrade, observers had to deal with a clumsy paper tape each month. With the new upgrade, observers now simply insert an SD memory card into the data logger (the same kind used in digital cameras), download the file to their computer, and e-mail the file to the NWS.

The outside of the unit looks the same. The new system still uses the same weighing bucket, which presses on a "load cell" and records the weight in the data logger. Precipitation is now measured to the nearest hundredth of an inch, instead of only the nearest tenth.

Fischer-Porter Gauge Digital Readout

Pat Hein prepares a new Fischer-Porter Gauge for deployment

Fischer-Porter Gauge

COOP Awards....

Consolidated Water Power Company received an honored **50 Year** Institutional Award at Wisconsin Rapids, Wisconsin. From left are Operations Manager Gary Romanski, Steve Stashek a power dispatcher, and MIC Gary Austin Green Bay Wisconsin.

Mr. and Mrs. Walt Kaszynski (left and center) receive a **40 year** Length of Service Award from OPL Pat Hein. Walt, the station manager of WOCO radio at Oconto, Wisconsin, held a radio talk show hosting MIC Gary Austin and OPL Pat Hein about the effects of El Niño, the cooperative program and upcoming winter forecasts.

John Czerwonka of Rosholt, Wisconsin, receives his **35 year** length of Service Award for his dedication to the Coop program. John is a retired postmaster who is now active with his tree farm.

Kevin Brewster, Coop Observer at the waste water treatment plant in Eagle River, Wisconsin receives his **30 year** Length of Service Award.

Olivia Zimmer (right) received her **25 year** length of service award with husband Gary Zimmer (left). This team takes observations at the LeFeber Boy Scout Camp south of Laona, Wisconsin.

Leslie Steffeck of Suring, Wisconsin, was presented his **25 year** Length of Service Award for his continued dedication to the Coop program.

Sue Steinhaus (center) received her **25 year** award for taking observations at Crivitz High Falls. On her right is our youngest observer in northeast Wisconsin, Mark Steinhaus. On the left is Dick Steinhaus, husband and previous weather observer from the WPS Dam at High Falls.

Jim Koth receives his **20 year** award for taking observations at the Rice Reservoir Dam in northern Wisconsin. Jim is also a 20 year employee of the Wisconsin Valley Improvement Company, owner of the site.

COOP Awards....

Juliette and John Guth are both dam operators for Wisconsin Valley Improvement Co. They were recently recognized for **20 years** of outstanding service for observations taken at the Eau Pleine Reservoir in central Wisconsin.

Wisconsin State Representative for the 35th Assembly District, Tom Tiffany, left, receives his **20 year** Length of Service Award from OPL Pat Hein. Tom has been taking observations for the NWS and Wisconsin Valley Improvement Co. at the Willow Reservoir in northern Wisconsin.

Rainbow Reservoir-Lake Tomahawk shop foreman for Wisconsin Valley Improvement Co., Dan Konopacky, on right, receives his **15 year** Length of Service Award. Accompanying him is Tim Wanta, Chief Assistant.

Observer Scott Cultice and trusted companion Sophie were presented a **10 year** Length of Service Award for providing precipitation and temperature readings for Appleton, Wisconsin.

Observer Richard Olson was presented his **10 Year** Length of Service Award for providing temperature and precipitation readings near Forestville, Wisconsin.

We Appreciate Our Volunteers!

NOAA's National Weather Service (NWS) in Green Bay could not perform its forecast and warning mission successfully, striving toward a Weather-Ready Nation, without volunteers – cooperative observers, hazardous weather spotters and amateur radio operators ("hams"). Respectively, their contributions are selfless, personal commitments to take and report daily weather observations, observe and report hazardous weather, relay hazardous weather observations and/or serve as a backup communications source during unexpected communications outages. Further, several hams actually volunteer their personal time directly at our station, to establish and maintain communications equipment in support of our hazardous weather operations – this could be at any time of day - serving as a valuable "channel of information" for other hams in the field!

Cooperative observers record temperatures and precipitation every single day of the year. Some have done so for many years in succession – that's outstanding dedication! Their observations, carefully measured in accordance with NWS guidelines, provide us with important weather information which permits us to know what has truly happened "on the ground", and assists us in making forecast decisions and providing information to the public. The observations also serve as the foundation upon which a national climate database is maintained, permitting the study and identification of long-term trends of weather patterns by a wide variety of organizations, both in government and the private sector.

Weather spotters, after learning and/or refreshing their knowledge of hazardous weather spotting at our spring training talks, assist us during hazardous weather events, in real-time in any season of the year, providing us with information about hazardous weather. Although we have high-technology equipment, like radars and satellites, we still rely on observers' eyes to let us know what is truly happening "on the ground" so we can make appropriate warning decisions. Some spotters relay their reports via ham radio, where radio links are sometimes the only way we receive reports of hazardous weather.

Without the volunteer service of our observers, spotters and hams, we could not provide the weather services which are expected of us by our tax-paying community – the service of our volunteers directly supports our nation becoming Weather-Ready. We and the citizens of north-central and northeast Wisconsin are truly indebted to you!

Gary Austin
Meteorologist-in-Charge

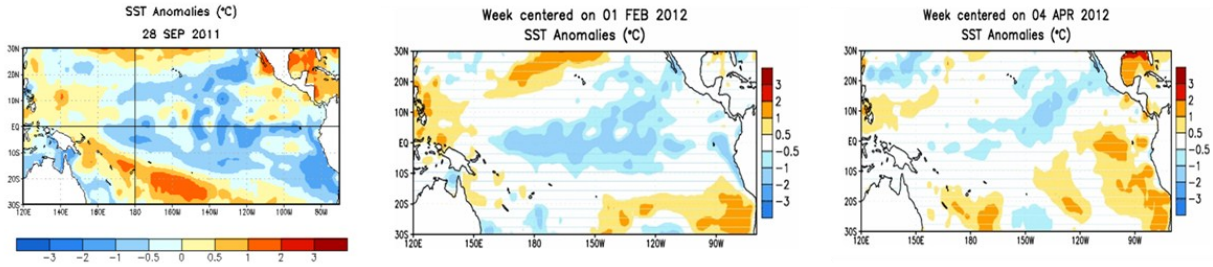
La Niña Continues to Weaken This Spring

By Ashley Wolf, Meteorological Intern and Roy Eckberg, Forecaster

Last summer, the climate models predicted the onset of La Niña conditions across the equatorial Pacific Ocean. By late September, La Niña conditions [see snapshot of sea surface temperature (SST) anomalies below] were present across the Pacific Ocean with temperature anomalies about 1 degree colder than average. La Niña is characterized as a periodic large scale cooling of the tropical regions of the Pacific Ocean. It is the cool phase of the El Nino/Southern Oscillation (ENSO cycle) in which SST anomalies across the central and east-central equatorial Pacific Ocean are cooler than normal. The cooler than normal water temperatures affect the tropical rainfall patterns from Indonesia to the west coast of South America. These changes in rainfall affect weather patterns across the globe.

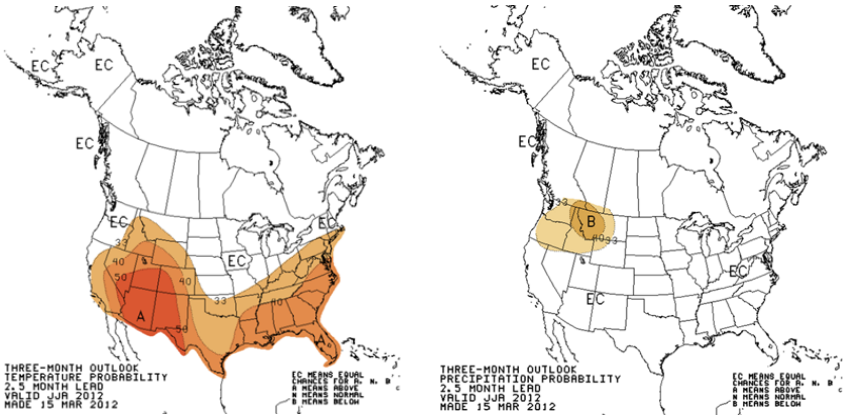
During a normal La Niña winter (December through February), the weather pattern features a highly amplified jet stream flowing across the United States, allowing for cold and stormy conditions across the northern United States. In Green Bay, 13 out of the 16 winters (81%) with a weak La Niña (SST values from -0.5 C and -0.9 C) were colder than normal. There is no strong correlation between La Niña winters and snowfall at Green Bay with nearly equal chances for above, below or near normal snowfall. However, the winter of 2011-2012 went down in the record books as the 2nd warmest winter on record since 1886. Most locations across north-central and northeast Wisconsin experienced one of the top ten warmest winters on record. Seasonal snowfall totals varied from at or slightly above normal across the far north to well below normal (10 to 20 inches) across central and northeast Wisconsin.

Why the marked contrast from what was expected this winter and what actually occurred? The answer may lie in the Arctic Oscillation (AO) and its cousin, the North Atlantic Oscillation (NAO). For most of the winter, the AO and NAO indices were in a positive phase. When the AO or NAO is in a positive phase, the storm track is usually farther north, thus fewer intrusions of Arctic air into Wisconsin. Less frequent intrusions of Arctic air usually result in much warmer than normal wintertime temperatures across the state. This was the case during the past winter. When cold air did arrive across the state, it did not take long for the cold air to retreat north back into Canada.



Snap shot of temperature anomalies across the Equatorial Pacific Ocean

According to recent ENSO model forecasts from the Climate Prediction Center, the weak La Niña that was in place this winter was dissipating this spring as seen in the temperature anomaly map on April 4th (above right) and is expected to become neutral by the summer. Neutral conditions mean that sea surface temperature anomalies across the equatorial Pacific Ocean are minimal (between -0.5 C and + 0.5 C), thus water temperatures are near normal values. The climate models are showing no clear signals in temperature and precipitation trends for the upcoming summer. There is an equal chance (EC) for above, below or near normal temperatures and precipitation.



Summer Temperature and Precipitation Forecast (June through August)

Looking ahead to next winter, some of the climate models are indicating that El Niño conditions could develop across the equatorial Pacific Ocean. El Niño occurs when the equatorial Pacific Ocean water temperatures are warmer than normal. If El Niño does occur next winter, there is a greater likelihood of above normal temperatures and below normal snowfall across the area. Although the ENSO can have a significant impact on wintertime temperatures, the phase of the Arctic Oscillation / North Atlantic Oscillation can sometimes negate the influences of ENSO. Unfortunately, the phase of the AO / NAO index cannot be forecasted beyond six weeks, and it can quickly change phase in a matter of a few days. Stay tuned!

Winter 2011/2012 Recap

By Roy Eckberg, Forecaster

Overall, the winter of 2011/12 was one of the warmest winters on record across north-central and northeast Wisconsin. The average temperature was 5 to 8 degrees above normal compared to a typical winter. The table below lists the average temperature for the winter, along with the ranking and comparison to the warmest winter on record for many locations across north-central and northeast Wisconsin.

LOCATION	2011/12 AVERAGE TEMPERATURE	RANKING	WARMEST WINTER ON RECORD
Appleton	26.7	2nd	26.8 – 1997/98
Brillion	25.6	2nd	27.0 – 2001/02
Chilton	26.1	4th	27.8 – 2001/02
Florence	20.5	3rd	23.3 – 2001/02
Green Bay	27.2	2nd	27.7 – 2001/02
Laona	20.0	5th	23.2 – 1997/98
Manitowoc	29.3	2nd	30.4 – 1931/32
Marinette	27.1	3rd	27.6 – 1997/98
Marshfield	22.7	5th	25.6 – 1997/98
Oshkosh	27.2	2nd	30.0 – 2001/02
Rhinelander	18.9	7th	24.8 – 2001/02
Stevens Point	23.8	6th	25.8 – 1931/32 & 1997/98
Sturgeon Bay	27.1	3rd	27.9 – 1997/98
Two Rivers	28.3	4th	29.0 – 1982/83
Wausau	23.6	3rd	26.9 – 1997/98
Wisconsin Rapids	25.4	4th	27.4 – 2001/02

Despite an ongoing weak to moderate La Niña and historical trends suggesting a colder than normal winter, why did the winter of 2011/12 end up being one of the warmest winters on record? One possible explanation may be related to the Arctic Oscillation (AO) and its cousin the North Atlantic Oscillation (NAO) which can help offset the impacts of La Niña or El Niño.

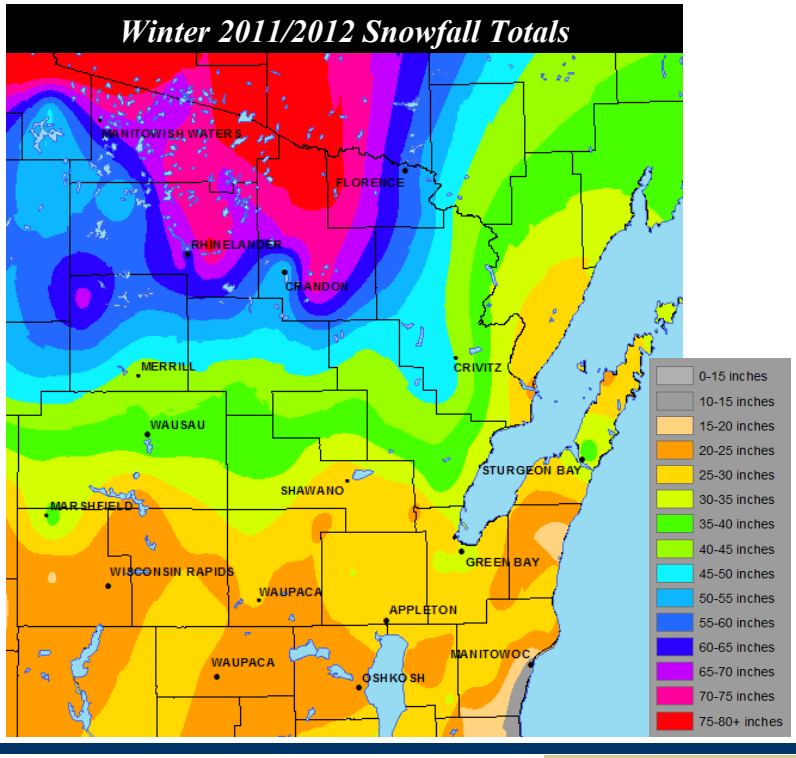
Please see article on page 9 for more info. For more information on the AO/NAO, please visit:

http://nsidc.org/arcticmet/patterns/arctic_oscillation.html

http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/ao.shtml

Snowfall was 10 to 20 inches below normal across the south and at or slightly above normal across the north. This was a far cry from the record snow of the previous winter where many locations reported 70 to 93 inches of snow for the season. The highlight of the winter was the intense winter storm on February 28th-29th that brought record snows to far northern Wisconsin. Rhinelander received 20.2 inches of snow during the storm, with 13.9 inches on February 29th. There were isolated reports of 24 to 27 inches in far northeast Wisconsin.

Click **here** for a summary of the 2011/12 snowfall totals.



Space Weather - A Look at a Different Type of Weather

By Richard Mamrosh , Senior Forecaster

If you are reading this newsletter, you already know that the National Weather Service (NWS) issues forecasts and warnings for the United States, but did you know that the NWS has a related agency that issues forecasts and warnings for Space Weather? The Space Weather Prediction Center (SWPC) is part of the National Oceanic and Atmospheric Administration, as is the NWS. The SWPC is located in Boulder, Colorado, and is staffed 24 hours a day by scientists who constantly monitor the conditions on the sun. They issue routine forecasts of solar activity, and also issue warnings when solar events take place that will have impacts on people and property on the earth and in its atmosphere.

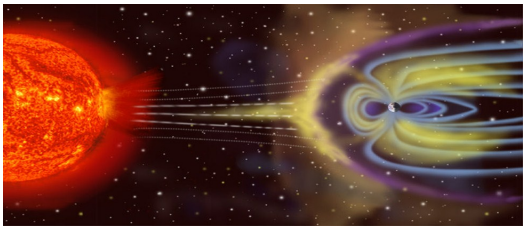
Basics of Space Weather: As you probably learned in grade school, the sun is a medium size star that produces light, magnetic fields and particles. These stream away from the sun and are known as the "solar wind". While the solar wind travels around a million miles an hour, you cannot feel it the way that you can feel the wind on earth. As the solar wind approaches the earth, it encounters the earth's own magnetic field, causing most of the solar wind to be deflected around the earth. The "normal" solar wind has little impact on the earth and its inhabitants.

Like weather on the earth, the sun has some predictable and unpredictable events that are often related to cycles. The earth has had warm periods and ice ages that occur over the course of thousands or millions of years, and short lived tornadoes that last less than a minute. The sun also goes through long and short cycles of activity. Most people have heard of the 11 year cycle of sunspots on the sun, but even this cycle is superimposed on longer cycles that last hundreds or thousands of years. A prolonged minimum of sunspot activity occurred from the middle 1600s to the early 1700s and is said by some scientists to have caused the "Little Ice Age". Sun spots are relatively cool (4,000 C) areas of the sun that result from strong magnetic fields that keep some of the sun's energy from reaching its surface. Increasing sun spot activity is associated with active periods of the sun.

The Sun is Entering an Active Period: As the sun enters an active period, there is an increased amount of sunspots and solar events that can affect the earth and its atmosphere. We are approaching an active period now. A solar maximum was forecast to occur last year, but due to a very low amount of sunspots in 2008 and 2009, forecasters have revised their forecasts for it to reach a maximum sometime in 2013. Solar events include solar flares, coronal mass ejections, and solar prominence eruptions. Each of these events increases the emission of electromagnetic radiation and accelerates energetic particles, which increases the speed of the solar wind.

Solar Flares: A solar flare is seen as a sudden variation of brightness across the electromagnetic spectrum. This often leads to the acceleration of electrons and protons traveling away from the sun at velocities in excess of half the speed of light. At these speeds, protons can reach the Earth in around 15 minutes. Since they occur suddenly, and can impact the earth quickly, they are difficult to forecast. These flares send hazardous radiation towards the earth, but people on the ground are generally protected by our atmosphere. Passengers flying on aircraft at 40,000ft are at some danger, especially those flying within a few thousand miles of the poles. For this reason, airlines will often reroute a flight to a more southern flight path. Astronauts are safe inside a space craft, but could be in great danger if caught outside during a solar flare. Solar flares can disrupt radio communications, satellites and Global Positioning Systems, but normally for short periods of time. Solar flares are also highly directional; in other words they have little impact unless directed towards the earth. Most solar flares go in other directions and miss the earth.

Coronal Mass Ejections: These are intense solar storms that send enormous amounts of solar material into space. These take longer to impact the earth than solar flares, but can have a greater impact. Significant geomagnetic storms can result that can induce power currents in electrical devices, and destroy or disable satellites, communications equipment and even power grids. A large geomagnetic storm in 1989 caused power grids to fail and left millions of people in the dark across Quebec and parts of the northeastern United States. An even larger storm occurred in 1859 that disrupted telegraph lines and killed some people working near electrical equipment. With our current reliance on cell phones, satellites, and electricity in general, a geomagnetic storm on the scale of the 1859 one could result in billions or trillions of dollars in economic losses. A more pleasant result of coronal mass ejections and solar storms are beautiful auroras, which can sometimes be seen as far south as the Gulf Coast. These auroras are caused by the interaction of high-energy particles (usually electrons) with neutral atoms in earth's upper atmosphere.



Coronal mass ejection distorting the earth's magnetic field

Colorful auroras over the arctic

Solar Prominences: Solar prominences are anchored to the sun's surface, and extend outwards into the sun's hot outer atmosphere, called the corona. A prominence forms over timescales of about a day, and stable prominences may persist in the corona for several months, looping hundreds of thousands of miles into space. Scientists are still researching how and why prominences are formed. Because they are not ejected towards the earth like solar flares, they have much less impact than solar flares and coronal mass ejections.

Learn more about Space Weather - **http://www.swpc.noaa.gov/**

SCOUT DAY ANOTHER HUGE SUCCESS!

By Scott Cultice, Hydrometeorological Technician

On September 24, 2011, over 100 Boy Scouts and Girl Scouts from numerous troops and packs in the Brown County area participated in Scout Day at the National Weather Service Office in Green Bay. The Scouts have long been guided by their motto "Be Prepared", which applies to weather safety, a critical part of the National Weather Service mission.

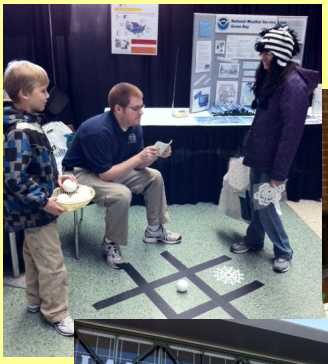
The Scouts participated in six different activities, each at a different station. Weather safety and preparedness were two of the main topics the Scouts learned about in meeting their "weather merit" (boys) and "weather-watch" (girls) badges. Other topics included an introduction to weather, clouds, the water cycle, precipitation, acid rain and weather careers. One popular activity, to highlight all topics, was Weather Jeopardy. There were also hands-on activities in which the Scouts had the opportunity to build a simple weather instrument, like an anemometer. In addition, the Scouts also learned how weather affects different industries, including farming, aviation, the Coast Guard, and construction from real professionals in their fields. Their final stop was to participate in a simulated weather balloon release.

Scout Day at the NWS Green Bay office. NWS forecast staff and volunteers from the local chapter of the American Meteorological Society helped make the event a success. Clockwise, starting with upper left: Scouts registering for the event; Senior Forecaster Teri Egger instructing how clouds form; a simulated balloon release; Hydrometeorological Technician Scott Cultice allowing Scouts to hold a real weather balloon; volunteer Bob Egger demonstrating how a homemade anemometer works; volunteers telling how weather affects different industries; Forecaster Roy Eckberg presenting an overview of the NWS Green Bay office operations; volunteer Julie Bredael showing how the water cycle works; weather safety Jeopardy game. Photos: Peg Zenko.

NWS ON THE ROAD

Superbowl of Safety

Members of the National Weather Service in Green Bay joined forces with the Safe Kids of Greater Green Bay Organization and the Green Bay Packers to present the NWS booth at the annual Superbowl of Safety. Local organizations as well as volunteer members of the Green Bay community gathered at the Lambeau Field Atrium on January 28 to provide a wide range of winter safety activities for children. The National Weather Service booth focused on precautions kids and parents can take to ensure they stay safe during winter weather. This included an example of a car safety kit for parents to keep in the car in case of dangerous road conditions, a snowflake making station with facts about snowflakes and how to stay warm when outside, and a tic-tac-toe trivia game to help teach kids the best way to dress and stay safe in cold weather. A total of about 1500 kids and parents attended the event.



Scott Berschback playing winter weather safety tic-tac-toe

Ashley Wolf helps make paper snowflakes

Lambeau Field Atrium

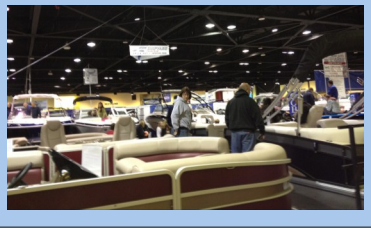
WBAY Boat Show

Local news station WBAY hosted the 56th Annual Boat Show February 16th through the 19th, and the Green Bay National Weather Service was in attendance to provide information on boating safety and marine weather. Exhibitors filled ShopKo Hall in Green Bay to allow local boating enthusiasts to indulge in every aspect of boating culture; including cruise vacation offers, waterfront home exhibits, outdoor living presentations, and -of course- boats of all shapes and sizes. Over 250 people stopped by the booth and talked to the NWS forecasters. Forecasters from the Green Bay office provided the public vital weather information on safe boating including brochures on severe storms, lightning, NOAA Weather Radio, and showed the public how to use the NWS Green Bay website. The NWS Green Bay website has a wealth of information including public and marine forecasts, radar, and climate data.

Forecasters talked with both amateur and professional boaters about the benefits of NOAA weather radio, safety weather tips while on the waters, and provided examples of the nearshore marine forecast put out by the Green Bay office. Staff also discussed with experienced boaters their tales of extreme weather while out on the lake. Several mariners indicated the bay became very rough in a severe storm last August. In this event, the strong winds were several miles ahead of a thunderstorm complex along a gust front. Although you can see severe storms miles ahead, the outflow boundary in some events can be well ahead of the main thunderstorm complex. The feedback from mariners provides forecasters a better understanding of when and what type of conditions lead to hazardous weather and waves on open waters and what type of precautions we can all take to stay safe. Collaboration between the National Weather Service and boaters is essential due to the lack of real-time weather observation sites on the Lake Michigan and the waters of Green Bay. Overall, the Boat Show was a great success.

Roy Eckberg staffs the NWS Green Bay booth

Will we see you at the 2013 WBAY Boat Show?



Office Happenings....

New Forecaster Intern Joins NWS Green Bay Staff

Ashley Wolf joined the staff of the Green Bay Weather Forecast Office as a Meteorologist Intern on August 14, 2011. Prior to coming to Green Bay, Ashley worked as a Student Career Experience Program (SCEP) student at the Center Weather Service Unit (CWSU) in Nashua, New Hampshire. The CWSU in Nashua is in the NWS Taunton (Boston) forecast area. At the CWSU, she helped forecast weather and created products that impacted aviation customers and flights throughout the northeast United States. In collaboration with Plymouth State University, the Nashua CWSU and the National Weather Service in Taunton, Massachusetts, Ashley conducted a research project on the weather patterns and prevailing winds that cause fog at Boston Logan International Airport. The NWS office will expand upon her research in future wind projects for Boston Logan Airport.

Ashley completed her bachelor's degree in Meteorology along with a minor in technical Mathematics at Plymouth State University in Plymouth, New Hampshire. Besides her knowledge of aviation meteorology, she will bring a passion for hazardous weather and a strong desire to learn all aspects of our operations and is excited to continue her National Weather Service career in Green Bay.

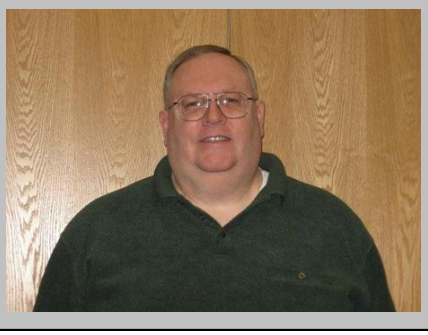
NWS Green Bay Receives Recognition from NOAA

The NWS Green Bay office was recognized for outstanding work during the historic northeast Wisconsin tornado outbreak of April 10, 2011. Ten tornadoes struck northeast Wisconsin, the largest outbreak in northeast Wisconsin weather history. Three of the tornadoes that hit the area were classified as "strong", including a half-mile wide EF3 twister that hit Merrill.

Staff at the NWS Green Bay office provided forecast and decision support services to emergency management and other officials leading up to the event. Tornado Warnings were issued, on average, 22 minutes before the twisters hit local communities. Only one injury occurred with the storms.

NWS Green Bay and Ham Community Loses a Member

Bob Sanders, long time hydrometeorological technician (HMT) at NWS Green Bay, passed away unexpectedly in his sleep on May 21, 2011. He had just completed 30 years of federal service, with over 16 years at the NWS Green Bay office. He was 54 years old.



Bob joined the NWS in 1985 after serving in the U.S. Navy as an Aerographer's Mate. While at NWS Green Bay, Bob, an avid amateur radio operator, was liaison between the office and amateur radio groups that serve as storm spotters for the NWS. He was also the NWS Green Bay program leader for NOAA Weather Radio, ensuring high-quality broadcasts on the all-hazard weather radio stations. Bob was an avid Packers fan and dedicated employee and is truly missed!

The March 22-23, 2011 Winter Storm: A Review of a Record Late Season Snow Storm

By Mike Cellitti, Forecaster and Eugene Brusky, Science Operations Officer

A slow moving low pressure system tracked from the northern Great Plains to the southern Great Lakes, and produced heavy, wet snow and occasional thunder-snow over central and northeast Wisconsin on March 22-23, 2011. During the two-day period, many locations from Sturgeon Bay to Rhinelander reported over a foot of snow. In addition, thunderstorms were reported in the Green Bay area from about 8:15 pm on the evening of March 22 until just after midnight on March 23, and were often accompanied by heavy snow and sleet. Although thunderstorm activity ceased during the overnight hours, periods of moderate to heavy snow continued over parts of northeast and north-central Wisconsin through the afternoon of March 23. The end result was a record setting two-day snowfall at Green Bay, which recorded 17.8 inches of snow (Figure 1).

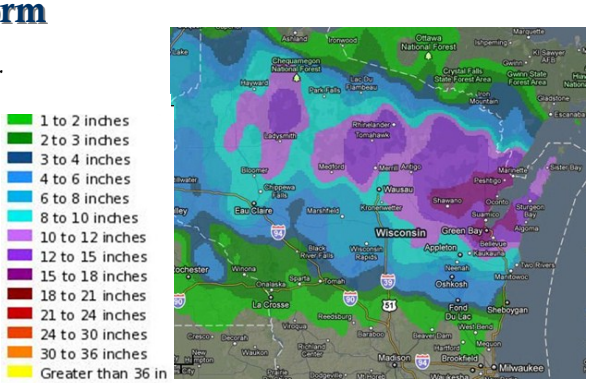


Figure 1. March 22-23 storm total snowfall.

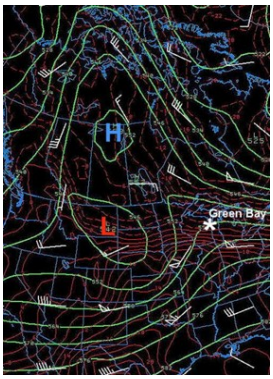


Figure 2. Upper air pattern across North America on March 22.

The upper air pattern across North America on March 22 was characterized by a split flow regime, with an upper level low pressure system undercutting a large ridge centered over western Canada. This pattern allowed two vastly different airmasses to collide over Wisconsin (Figure 2). As the low moved southeast over the northern Great Plains, a warm and moist airmass surged northward out of the Gulf of Mexico and into the southern Great Lakes region, while a cold and very dry airmass flowed southwest out of Ontario. This collision of airmasses set the stage for an extensive and persistent band of precipitation stretching from the eastern Dakotas, across northern Wisconsin, and to the eastern Great Lakes (Figure 3).

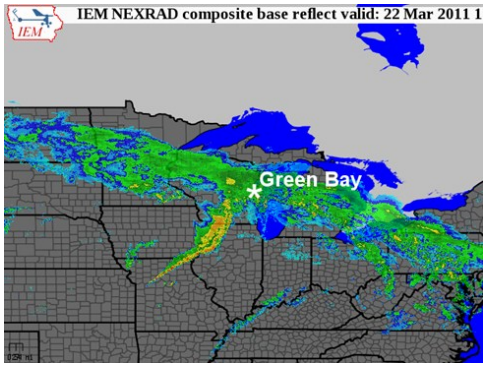


Figure 3. Regional radar image on March 22 at 11

The first round of widespread heavy precipitation (Figure 4A) arrived late in the afternoon and into the evening over central Wisconsin. The precipitation consisted of heavy snow and sleet with reports of pea size hail at Oshkosh and sporadic lightning. As the snow worked northeast into the route 29 corridor, precipitation type was mainly snow with quarter mile visibilities and snowfall rates of 1-2 inches per hour.

The second push of heavy precipitation (Figure 4B), which originated as severe thunderstorms over Iowa, moved across the forecast area during the overnight hours. At 11:14 pm, it was reported that lightning caused a fire in a structure in Wausau. In addition to the heavy snow, 1.5 inches of sleet was reported in Oshkosh late in the evening of March 22. By 6 am on March 23, 10-15 inches of snow had already accumulated from Rhinelander southeast to Sturgeon Bay.

By the early morning hours of March 23, the widespread heavy precipitation moved northeast into northern Lower Michigan, leaving narrow, lake-enhanced snow bands over the Fox Valley and far northeast Wisconsin (Figure 5). These bands remained relatively stationary, waxing and waning in intensity over a 9 hour period during the morning of March 23. The persistence of one of these snow bands (accompanied by winds gusting to 40 mph) effectively prolonged the period of moderate to heavy snow over the Green Bay area that contributed to the record snowfall totals. One last round of heavy snow then arrived late in the morning and into the early afternoon of March 23 which added another 1 to 3 inches on top of the already gaudy totals.

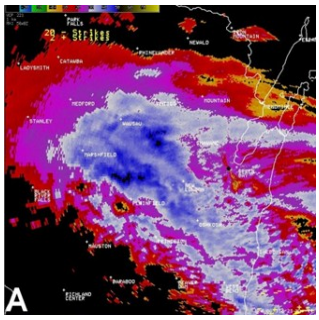


Figure 4A. KGRB radar image on March 22 at 5:31 pm.

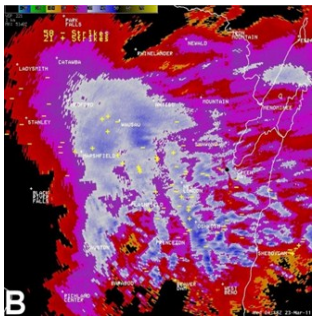


Figure 4B. KGRB radar image on March 22 at 11:18 pm.

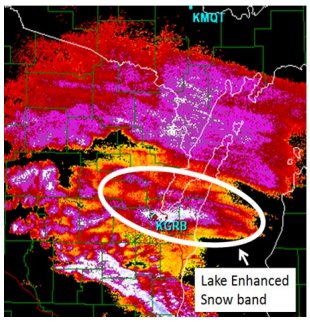


Figure 5. KGRB radar image on March 23 at 8:07 am.

The *Packerland Weather News*

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